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Validity and Reliability of a Core Competencies Instrument for Nursing Students

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ABSTRACT

Introduction: One of the basic competencies to become a professional nurse is clinical performance. Therefore, many studies use tools modified and supplemented by Choi to measure the clinical performance of nursing students, but there is no tool to measure the core competencies of nursing students.

Aim/Objectives: This methodological study tested the reliability and validity of a self-report instrument measuring the core competencies of nursing students. Internal consistency, reliability, and construct validity were assessed using confirmatory and exploratory factor analysis.

Methods: Questionnaire data was collected from 249 nursing students at four universities in J province, South Korea, from August 20 to September 30, 2020.

Results: The core competencies showed reliable internal consistency, with a Cronbach's alpha of 0.90 for the total scale. Factor loadings of the 32 items on seven subscales ranged from 0.53 to 0.88, and three factors explained a total variance of 66.22%. The seven subscales model was validated by confirmatory factor analysis (root mean square residual <0.05, comparative fit index >0.90).

Conclusions: The results demonstrate that the instrument is useful in measuring the core competencies of nursing students.

Key Words: Factor analysis, Professional competence, Validation study, Seven subscales model, Core potencies, Confirmatory and exploratory factor

INTRODUCTION

Necessity of Research

In addition to the paradigm shift in the fourth industrial revolution and future education, interest in the clinical performance ability of nursing students is increasing in medical institutions with a view to hiring talented people with professional capabilities. To support and manage the quality of nursing education and the performance of nursing students, the Korea Nursing Education Evaluation Institute provides education to strengthen the core practical skills necessary for clinical sites through learning in an outcomes-oriented education system.¹ Accordingly, the Korea Nursing Education and Evaluation Institute suggests seven core competencies that nursing students should have at the time of graduation: liberal arts and major knowledge and nursing skills,

communication and cooperation skills between specialized fields, critical thinking skills, legal and ethical responsibility, leadership, research performance, and global health policy change response skills.² The core competencies proposed by the Korea Nursing Education and Evaluation Agency compose the basic competency necessary to become a professional nurse.

One of the basic competencies to become a professional nurse is clinical performance. Therefore, many studies use tools modified and supplemented by Choi³ to measure the clinical performance of nursing students, but there is no tool to measure the core competencies of nursing students. The Korea Collegiate Essential Skills Assessment (K-CESA) is a competency-based curriculum that consists of communication; global; resource, information, and technology utilization; comprehensive thinking; interpersonal; and self-man-

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agement competencies.⁴ As each school has changed into a core competency-oriented curriculum to cultivate competent human resources, research on developing and validating core competency diagnostic⁵ and measurement tools for college students is actively being conducted. In particular, the core competency measurement tool developed by Park and Song⁶ which measured the core competencies of college students, is based on the core competencies of K-CESA and includes communication competencies suitable for analyzing the characteristics of domestic college students. The core competency measurement tool developed by Park and Song⁶ reflects the changing needs of society and includes creative thinking and social ethics competencies, which are personal competencies.

Research Purpose

This study aims to confirm the validity and reliability of the tool created by Park and Song⁶, which includes the core competency measurement tool of K-CESA developed at the national level, to determine its appropriateness as a core competency measurement tool for nursing students. Once confirmed, this tool can be used as basic data to identify the core competency level of nursing students in the future and promote the development of competency enhancement programs for each level. The purpose of this study is to verify the validity and reliability of the core competency measurement tool for college students developed by Park and Song.⁶

MATERIAL AND METHODS

Study Design

This was a methodological study to verify the validity and reliability of the core competency measurement tool developed by Park and Song⁶ to assess the basic competencies required for becoming a professional nurse in the Department of Nursing.

Research Subjects

According to Munro⁷, the research sample size should be at least 10 times the number of the measurement tool questions. Moreover, Jackson⁸ stated that a structural equation model, which includes a measurement model for a verifiable factor analysis, requires a sample of at least 200 respondents. Following Munro⁷, and considering the tool's composition of 10 general characteristics, core competencies, and clinical performance items, the current study required a sample of at least 120 respondents. The structural equations, including measurement models for verifiable factor analysis, met their application criteria as they required a sample size of at least 200 respondents.

Research Tools

Core Competencies: To measure the core competencies of nursing college students, a core competencies measurement tool developed by Park and Song⁶; see also Munro⁷) was used. The tool measures six sub-competencies: seven items to assess knowledge information utilization competency, nine for leadership (self-development, organizational cooperation), 10 for creative thinking (analysis, creative thinking), seven for global, seven for communication, and eight for social ethics (social problem understanding, service). Each item is rated on a five-point Likert scale, ranging from 1 point ("not at all") to 5 points ("very much so")—the higher the score, the higher the core competency. Cronbach's α was .95 for overall competency; .83 for communication, global, and creative thinking; .84 for knowledge utilization; 0.82 for leadership; and 0.81 for social ethics.

Clinical performance ability: To verify the criterion validity between the core competency measurement tool and nursing students' clinical performance, we used the clinical performance measurement tool developed by Lee et al.⁹, modified and supplemented by Choi³, and based on Schwirian's Six-Dimension Scale.¹⁰ Clinical performance is measured across five sub-domains, with nine items for professional development, six for interpersonal/communication, eight for education/cooperation, 11 for nursing skills, and 11 for nursing process. Each item is scored on a five-point Likert scale ranging from 1 point ("not very good") to 5 points ("very good"); a higher score indicates higher clinical performance. Reliability was established in the original study⁹ with a Cronbach's α value of .96, and .92 in Choi's³ study.

Data Collection and Analysis Method

Tool Development: To measure the core competencies of nursing students, the author provided written permission (via e-mail) for the use of the tool developed by Park and Song.⁶ Of the sub-competencies measured by the original tool, knowledge information utilization competency was changed to evidence-based practical competency, and social ethics competency to nursing ethics competency, based on the expert opinions of three professors.

To verify the validity of the core competency tool for nursing students, a group of experts, each with more than 10 years' clinical experience, and two PhD graduates verified the content feasibility index (CFI) of each item.¹¹ Each question was analyzed on a four-point Likert scale, ranging from 4 points for "very appropriate" to 1 point for "not appropriate at all." Following verification of the content validity, only questions with a content validity coefficient of 0.8 or higher were selected¹². The final 48 questions were composed of key competency measurement items, based on expert opinions of the terminology, vocabulary, and other content.

Twenty preliminary surveys were conducted with nursing students to verify the questions' clarity and ease of understanding, and the appropriateness of the questioning method. There are no clear criteria for the required sample sizes of preliminary surveys, but 20–30 people are generally considered sufficient.¹³ (Figure 1)

Data Collection: Data collection was conducted from October 26, 2020, to November 30, 2020. The purpose and method of the study were explained to the participants, and the study was conducted after obtaining their consent. The time required for completing the questionnaire was 10–15 minutes.

Data Analysis: The collected data was analyzed using IBM SPSS/WIN 23.0 and AMOS WIN 21.0.

- 1) Participants' general characteristics were analyzed using frequency, percentage, mean, and standard deviation.
- 2) The content validity index was measured and analyzed to verify content validity.
- 3) Item analysis for the construct validity verification was performed through normality verification, using the mean, standard deviation, skewness and kurtosis for each item, the corrected all-item correlation coefficient, and reliability when removing items.
- 4) Exploratory factor analysis (EFA) for construct validity verification was conducted by performing the Kaiser–Meyer–Olkin (KMO) and Bartlett sphericity tests, and calculating eigen values, explanatory power, and loading values using principal component analysis and Varimax rotation with SPSS 23.0.
- 5) Confirmatory factor analysis (CFA) for the construct validity verification was performed using AMOS 21.0 to obtain absolute fit index (AFI), incremental fit index (IFI), average variance extracted (AVE), and construct reliability (CR).
- 6) Pearson's correlation coefficients were used to verify criterion validity.
- 7) The internal consistency for reliability verification was confirmed using Cronbach's α coefficient.

Ethical Considerations

This study was conducted after approval by the Joint Institutional Bioethics Committee (IRB No: 2020-1133-003) to protect the participants, along with other ethical considerations. After the purpose and method of the study had been explained directly to all participants, they completed a consent form to indicate their voluntary participation. Participants were assured that they could withdraw from the study at any time, and that they would not be disadvantaged by doing so. The questionnaire was completed anonymously, and participants were assured that their responses would not be used for any purpose outside the study scope. A small compensation was provided after they had completed the questionnaire.

RESULTS

General Characteristics of the Participants

Participants' general characteristics are summarized in Table 1.

Item Analysis of the Tool

For the item analysis of the tool, the mean, standard deviation, skewness, and kurtosis of each item were evaluated. The original tool uses a 5-point Likert scale and consists of 48 items. The average score of each question was in the range of 2.58 to 4.27, and the standard deviation was 0.62 to 1.18. The skewness and kurtosis of each question were less than the standard ± 1.97 at the 5% significance level, satisfying normality.¹⁴ If the correlation coefficient between each item and all items is less than 0.30¹⁴, the contribution within the scale is evaluated as low. In this study, the correlation coefficient ranged from .38 to .71, which met the criteria without any items that lowered the reliability of the tool.

Factors Influencing the Health-Related Quality of Life

The factors affecting the subjects' health-related quality of life, multiple regression analysis was performed by selecting the general characteristics and the health-related characteristics that were significant in the crossover analysis as independent variables. Among the factors that had a significant influence on the subjects' health-related quality of life, male sex ($p=0.042$) and lower age ($p=0.008$) were associated with higher quality of life, while poor subjective health status ($p<0.001$), limitation of activity ($p<0.001$), and ≥ 60 work hours per week ($p=0.002$) were associated with decreased quality of life. The F-value representing the fit of the model was 13.02 ($p<0.001$). Thus, the model was suitable and the explanatory power of the model was 39.1% (Table 3).

Validity of the Tool: Construct Validity

Exploratory Factor Analysis: To conduct EFA for the construct validity verification, 44 items were used in the analysis except for one item removed through item analysis. To confirm the appropriateness of the factor analysis of the measured data, the KMO and Bartlett sphericity tests of standard relevance were performed.

As a result of performing the KMO test and the Bartlett sphericity test to determine the suitability of the sample, factor analysis was applied with sufficient evidence that it was not a unit matrix ($KMO=0.89$, $\chi^2=4329.37$, $p<0.001$). Analysis of the factor rotation using the main factor method confirmed that the number of factors with an eigen value of 1.00 or more was 7, and the number of factors in the sharply gentle elbow point was 7. To select items that represent the meaning of each factor well, items with a com-

monality of 0.40 or more and a maximum factor load of 0.50 or more were selected¹⁴. By repeatedly checking the commonality and factor loading amount, a total of 16 items were deleted, and there were no more items to be deleted before confirming the final items. As a result of the EFA, the factor loading amount of all items was 0.50 or more, and 66.22% of the total variance was explained. Therefore, seven factors explaining 66.22% of the total variance, and a core competency measurement tool for nursing college students with 32 questions, was confirmed. By factor, the first factor was nine questions with an eigen value of 4.90 and an explanatory variance of 15.29%, and the second factor was five questions with an eigen value of 3.44 and an explanatory variance of 10.75%. The third factor was five questions with an eigen value of 3.07 and an explanatory variance of 9.58%, and the fourth factor was four questions with an eigen value of 2.92 and an explanatory variance of 9.12%. The fifth factor had an eigenvalue of 2.54 and 7.74% for the explanatory variance. The eigen value was 2.20 for the 6th factor with an explanatory variance of 6.88%, and the 7th factor had an eigen value of 3.21 with an explanatory variance of 6.67% (Table 2). The factors derived through the EFA were named as concepts that could imply the content of each factor. The first factor was named evidence-based practical competence and related to information for solving nursing problems, as well as evidence-based professional knowledge and skills necessary for nursing. The second factor was named leadership competence, and related to cooperation with members and organizations to solve problems. The third factor was named creative thinking competence and concerned the exploration of various alternatives for problem-solving, and analyzing the cause of problems. The fourth factor was named global competence, and concerned various experiences with globalization and the ability to communicate in various languages. The fifth factor was named nursing ethics competence, and related to the interest and practice in solving social disadvantages and problems. The sixth factor was named communication competence, and considered communication and conversation with others. The seventh factor was named as self-management competence, relating to whether goals and plans for work can be established and implemented (Table 3).

Criterion-Related Validity

Reliability of the Instrument: The correlation between high reliability and validated clinical performance ability was analyzed to verify the criterion validity for the core competencies of nursing students. The correlation coefficient between the core competency and clinical performance of nursing students showed a significant positive correlation in this study ($r=.70$, $p<.001$) (Table 4).

DISCUSSION

This study verified the validity and reliability of the tool developed by Park and Song⁶ to measure the core competency of nursing students. Our results confirmed the measure to be suitable for assessing the core competency of nursing students. In addition, the tool showed a high correlation with clinical performance, thus securing criterion validity.

Seven factors were derived from this study. The first, “evidence-based practice competency,” comprised nine items, including “I can analyze the knowledge and information needed for nursing by myself.” Its explanatory power was 15.29%, the highest among the factors. Evidence-based practice competency is based on evidence-based practice for patient safety, improvement of nursing quality, and professional practical nursing, involving exploring and critically analyzing the best evidence for nursing problems that may occur in clinical practice¹⁵, as well as the provision of competent nursing care.

The second factor, “leadership competency,” was derived from five items, including “I communicate actively with my team members to carry out their work,” and “I actively participate to solve the difficulties of my organization.” Leadership competency is an essential factor in building a team to achieve nursing goals, which is required to respond innovatively to the rapidly changing health care industry, and to achieve the goals of nursing organization effectively¹⁶. It is desirable to develop nursing leadership in nursing students so that these skills can be exerted in performing their duties and roles as nurses.

The third factor, “creative thinking competency,” was derived from five items, including “When I face a difficult task to solve, I look for alternatives.” As the paradigm of nursing changes from job-centered to competency-centered, nurses must approach the problems they face in a new way, create and implement various solutions, and adapt nursing practices to the characteristics and patterns of each patient. It is the competency of nurses that must be developed for this purpose.¹⁷

The fourth factor, “global competency,” was extracted from four items, including “I can communicate with foreigners in one or more foreign languages (English, Japanese, Chinese, etc.).” It involves knowledge of culture, language, and global dynamics, as well as cross-cultural communication capabilities.¹⁸ It is considered a necessary skill in nursing.

The fifth factor, “nursing ethical competency,” was derived from three items including “I encourage people around me to volunteer,” and “I am interested in serving others.” In caring for patients with nursing problems, it is necessary to understand the rights of the patients based on bioethical principles and nurses’ moral character and virtue¹⁹. Therefore, nursing ethics competency is a very important factor in the ability

to assess and practice independently, serving others, and explaining the importance of service to others as the basis of human-centered nursing.

For the sixth factor, “communication competency,” three items were derived, including “It is not difficult for me to understand others’ thoughts in conversations with friends or parents.” It is necessary to identify the needs of various participants in the nursing field; identify problems; provide physical nursing, emotional support, education and counseling; and cooperate with health care professionals and exchange information⁴. In addition, to solve the problems of nursing recipients, communication with guardians and health care workers is an essential factor, and operating the curriculum as a required subject in nursing colleges is a basic competency required for subject learning.

For the seventh factor, “self-management competency,” three items were extracted, including “If I plan something, I can put it into practice.” The self-management competency of college students refers to the pursuit of knowledge, skills, and abilities that students set as their own personal goals.²⁰ As such, to acquire the necessary abilities and qualities for one’s life and career, self-management competency can lead to a self-directed life and the ability to make plans for certain tasks, and to put them into practice.

This study confirmed the validity and reliability of the core competency measurement tool. Hence, it can be used as a basic tool to identify and evaluate the core competency level of nursing students, thus producing competent nurses who faithfully perform their roles and duties as health care workers. In addition, it can be used to collect basic data to develop and effectively implement educational programs – as part of both standardized curriculums and non-curricular courses – to improve the core competencies of nursing students and nurture future nursing talents.

CONCLUSION AND SUGGESTIONS

This study was conducted to verify reliability and validity of the core competency measurement tool⁶ developed for measuring the core competencies of nursing students. Through this study, it is expected that universities will support customized learning activities based on the core competencies of nursing students, and that this instrument will be used as basic data to raise the core competency level of nursing students. Fostering future nursing talent is important to cope with the rapidly changing medical field, which requires constant efforts and attention to improving nursing students’ capabilities in various fields such as educational institutions and clinical nursing.

The limitation of the participants of the study was that they were nursing students from four universities located in one

region. Therefore, it is suggested that it is necessary to confirm the research results by expanding into a wider range of participants and samples.

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Table 1: General Characteristic of Participants (n=249)

Characteristics	Categories	n (%)	Mean±SD
Gender	Female	209 (83.9)	
	Male	40 (16.1)	
Age (year)	≤ 23	188 (75.5)	23.50±5.22
	≥ 24	61 (24.5)	
Religious	Yes	80 (32.1)	
	No	169 (67.9)	
Marital status	Single	235 (94.4)	
	Married	14 (5.6)	
Student classification	3rd year	170 (68.3)	
	4th year	79 (31.7)	
Living status	With family	143 (57.4)	
	With relative	2 (0.8)	
	With friend	14 (5.6)	
	Alone	41 (16.5)	
	Dormitory	49 (19.7)	
Grade point average (GPA)	≥4.0	37 (14.9)	3.50±0.39
	3.0~<4.0	202 (81.1)	
	<3.0	10 (4.0)	

Table 1: (Continued)

Characteristics	Categories	n (%)	Mean±SD
Extracurricular activities	None	142 (57.0)	
	1	79 (31.7)	
	≥2	28 (11.2)	
Reason for choosing the program	Aptitude	87 (34.9)	
	Advice	51 (20.5)	
	Employment rate	95 (38.2)	
	Admission scores	11 (4.4)	
	Others	5 (2.0)	
University satisfaction	Satisfied	98 (39.3)	
	Moderate	115 (46.3)	
	Dissatisfied	36 (14.4)	

Note. SD=Standard deviation

Table 2: Exploratory Factor Analysis (N=249)

Factor/Di- mension	Items	Mean±SD	Component							Corrected item- total correlation	Cronbach's α
			1	2	3	4	5	6	7		
Evidence- based	28. I can analyze the knowl- edge and information needed for nursing by myself.	3.82±0.71	0.793							0.69	
Practice Competency (Factor 1)	29. I can analyze the knowl- edge and information needed for nursing through various channels.	3.87±0.74	0.738							0.67	
	27. I try to gather expertise in areas that I am interested in besides nursing knowledge.	3.79±0.86	0.672							0.63	
	25. I can understand gen- eral nursing knowledge and skills.	3.95±0.63	0.670							0.66	
	42. I can judge right from wrong about nursing prob- lems.	3.89±0.73	0.660							0.67	0.90
	26. I can find the information necessary to carry out nursing activities.	4.00±0.63	0.652							0.60	
	31. I can select the necessary information from the available information to solve nursing problems.	3.83±0.67	0.626							0.58	
	43. I try to figure out what causes nursing problems.	3.85±0.73	0.540							0.63	
	30. I try to integrate a lot of the information I have col- lected for nursing.	3.74±0.66	0.529							0.56	
	Total	3.85±0.52									

Table 2: (Continued)

Factor/Di- mension	Items	Mean±SD	Component							Corrected item- total correlation	Cronbach's α
			1	2	3	4	5	6	7		
Leadership Competency (Factor 2)	36. I communicate actively with my team members to carry out their work.	3.92±0.83		0.787							0.86
	40. I actively participate in solving the difficulties of my organization.	3.97±0.77		0.776						0.60	
	38. When I work, I tend to work in cooperation with others.	4.04±0.74		0.734						0.50	
	35. As a member of my group, I try to communicate first, even if I am not familiar with the group members.	3.75±0.90		0.727						0.50	
	37. I share my information with my team members to carry out the work of my group.	4.04±0.70		0.709						0.59	
	Total	395±0.64									
Creative Thinking Competency (Factor 3)	15. When I proceed with the work, I check from various perspectives to see if there are any problems.	3.85±0.76			0.727					0.55	0.84
	19. When I face a difficult task to solve, I look for alternatives.	3.96±0.72			0.714					0.57	
	18. I think of various ways to solve a problem.	3.89±0.73			0.713					0.61	
	16. When I find a problem while I'm working on it, I analyze the cause of the problem.	3.90±0.77			0.695					0.61	
	23. I predict what the results will be based on the information given.	3.90±0.70			0.582					0.53	
	Total	3.90±0.57									
Global Com- petency (Factor 4)	9. I can communicate with foreigners in one or more foreign languages (English, Japanese, Chinese, etc.).	2.70±1.13				0.876				0.44	0.86
	10. I can acquire professional knowledge in one or more foreign languages (English, Japanese, Chinese, etc.).	2.58±1.12				0.840				0.44	
	8. I can read simple sentences in foreign languages (English, Japanese, Chinese, etc.).	3.18±1.07				0.825				0.48	
	12. I try to gain various experiences to become a talented person in a globalized era.	3.45±1.00				0.675				0.56	
	Total	2.98±0.90									
Nursing Ethical Competency (Factor 5)	48. I encourage people around me to volunteer.	3.06±1.18					0.877			0.45	0.88
	47. I am practicing volunteerism to help the socially disadvantaged.	3.35±1.09					0.863			0.63	
	46. I am interested in serving others.	3.73±1.02					0.845			0.51	
	Total	3.38±0.99									

Table 3: (Continued)

Factor/Di- mension	Items	Mean±SD	Component							Corrected item- total correlation	Cronbach's α
			1	2	3	4	5	6	7		
Communi- cation	6. It is not difficult for me to understand others' thoughts in conversations with friends or parents.	4.27±0.66						0.783		0.50	0.79
Competency (Factor 6)	7. When I disagree with others, I can listen to the other person's side of the story and come to an agreement.	4.19±0.67						0.742		0.54	
	5. I can communicate my thoughts in conversation with others.	4.27±0.64						0.666		0.56	
	Total	4.24±0.55									
Self-man- agement	33. If I plan something, I can put it into practice.	3.75±0.90							0.804	0.51	0.77
Competency (Factor 7)	32. I make a plan before I start something.	3.82±0.90							0.787	0.40	
	34. When I'm done, I check the level of achievement.	3.74±0.87							0.723	0.52	
	Total	3.77±0.72									
Eigen value			4.90	3.44	3.07	2.92	2.54	2.20	2.21		0.92
Explained variance (%)			15.29	10.75	9.58	9.12	7.94	6.88	6.67		
Total explained variances (%)			15.29	26.04	35.62	44.74	52.68	59.56	66.22		

Note. SD=Standard deviation

Table 3: Confirmatory Factor Analysis (n=249)

Dimensions	No	Standardized estimate (β)	SE	C.R	Factor (r)							AVE	CR
					1	2	3	4	5	6	7		
Evidence-based Practice Compe- tency	28	0.84	0.15	9.29									
	29	0.80	0.20	9.06									
	27	0.69	0.38	8.29									
	25	0.75	0.17	8.73									
	42	0.70	0.27	8.37	1							0.65	0.92
	26	0.69	0.21	8.30									
	31	0.34	0.27	7.84									
	43	0.62	0.33	7.71									
	30	0.56	0.30	-									
Leadership Com- petency	36	0.85	0.19	13.57									
	40	0.80	0.21	12.77									
	38	0.66	0.31	10.35	0.59	1						0.68	0.91
	35	0.67	0.44	10.46									
Creative Think- ing Competency	37	0.76	0.21	-									
	15	0.69	0.30	8.80									
	19	0.75	0.23	9.28									
	18	0.75	0.23	9.30	0.73	0.49	1					0.66	0.91
	16	0.76	0.25	9.38									
	23	0.62	0.30	-									

